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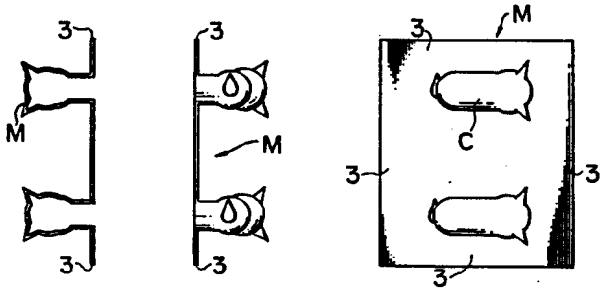
(54) Elastic mould and method for manufactring the same.

(57) An elastic mould (M) comprises a pattern and a fixing sheet (3) which is integrally mounted at open edge of the pattern. The elastic mould (M) is manufactured by dipping a pattern unit (A) comprising a pattern (2) mounted on a plate (1) into an elastic body-producing solution (b) to form a gel-like elastic film (c), withdrawing the film coated pattern unit (A), drying and vulcanizing the film (c), and peeling the vulcanized elastic film (c) off the pattern unit (A) to obtain a mould (M) having a fixing member (3) as an integral part thereof.



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TITLE OF THE INVENTION

ELASTIC MOULD AND METHOD FOR MANUFACTURING THE SAME

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to elastic moulds for the production of such castings as ice, ice cream, chocolate, jelly, cube sugar, fish paste, soap and concrete. This invention also relates to methods for manufacturing the above elastic mould.

Description of the Prior Art

At present, jelly and chocolate have been produced by casting them in a large mould and cutting the cake thus formed into a prescribed size. Alternatively, an array of moulds has been used to obtain, the required number of products in one lot.

However, such conventional moulds as have been used in casting confectionary materials are all metal moulds, especially split moulds. These split moulds tend to leave the joint of the mould on the surface of the product thus formed, resulting in poor appearance and lower product value. Furthermore, shape design has been restricted because certain subtle shapes including reverse-tapered one are hard to obtain. In

addition, the use of the split mould makes it difficult to withdraw the product from the mould and is often found to be much costly.

Thus, according to this invention, elastic moulds are used to produce desired products. Conventional methods for the manufacture of the elastic moulds such as the rubber-made moulds comprise dipping only a pattern itself which is mounted on a plate. The elastic mould thus manufactured, however, does not have any fixing sheet which is necessary for holding the elastic mould to a moulding machine.

Thus, the principal object of the present invention is to provide a novel and industrially feasible method of manufacturing elastic moulds which is characterized in that the fixing sheet is produced as an integral part together with the elastic mould to replace the conventional metal mould.

SUMMARY OF THE INVENTION

The present invention is provided to solve the aforementioned problems and characterized in that an elastic mould comprises a pattern and a fixing sheet which is integrally mounted at open edge of the pattern and in that a method of manufacturing the elastic moulds comprises dipping a pattern mounted on a plate

into an elastic body-producing solution to form a gel-like elastic film, drying and vulcanizing the object thus formed, and peeling the elastic film off both the pattern and the plate to obtain a mould with a fixing sheet attached to it.

This elastic mould is used as follows. The using method comprises a pouring step where material is poured into an elastic mould, a hardening step where the poured material is hardened, and a withdrawal step where the hardened object is withdrawn from the inside of the elastic mould.

In the pouring step, a fixing of the elastic mould is necessary during pouring operation of the material. Further, in the hardening step, a fixing of the elastic body is necessary.

In one example of the withdrawal step, the mould is loosened by pulling the fixing member (sheet), and then the object thus hardened is pushed from the opposite side of the fixing member attached to the mould. Hence, the fixing member functions as a pulling member, too.

Alternatively, in another example of the withdrawal step, a vacuum can be utilized for removing the hardened product. The fixing member supports a vacuum chamber which is tightly connected with the mould.

The object is then withdrawn by applying a vacuum. Hence, in this case the fixing member functions as a supporting member, too.

As an elastic mould according to the present invention comprises a pattern and a fixing sheet (member) which is integrally mounted at open edge of the pattern, the elastic mould can be easily used.

The manufacturing method of the elastic mould will be hereinafter described with an embodiment using a natural rubber latex solution as the elastic body-producing solution.

First, a pattern unit to be dipped in the solution is manufactured by mounting a model pattern of predetermined shape on a plate.

Secondly, the pattern unit is dipped into a natural rubber latex solution. The latex should contain elastic rubber compositions to provide elongation for the rubber-made mould. Solidification in the mould occurs either by cooling or heating and the compositions of the above rubber-made mould should vary accordingly. Oil-resistant rubber latex must be selected for an oily material such as chocolate.

The pattern unit is usually allowed to be dipped in the natural rubber latex solution until the rubber compositions adheres in a thickness of 0.8 to 1.0 mm.

It should be noted that the rubber compositions adhere to the plate as well as the model pattern, both of which have been dipped into the latex solution.

Afterwards, after the object thus formed is dried in the drier of 60 - 80°C for approximately 60 to 90 minutes, it is vulcanized. The product mould is then taken out from the pattern. It should also be noted that the mould is mounted on the surface of the rubber plate. Therefore, the flat plate thus formed functions as a fixing sheet for the product mould.

As an elastic body-producing solution, a silicone rubber, an urethane rubber and a butadiene rubber in addition to the natural rubber latex can be used.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawing, there is shown a preferred embodiment of this invention. Fig. 1 is a block diagram of an use of an elastic mould according to the present invention. Figs. 2 and 3 illustrate the front and side views of the pattern unit to be dipped. Figs. 4 to 9 show the manufacturing steps of the present invention. Fig. 4 is a partial, sectional view showing the pattern dipped into a coagulating solution. Fig. 5 is a partial, sectional view showing the pattern taken out from the coagulating solution. Fig. 6 is a

partial, sectional view showing the pattern dipped into a rubber latex solution. Fig. 7 is a partial, sectional view showing the pattern which has been taken out from the rubber latex solution. Fig. 8 is a partial, sectional view showing a rubber film which has been detached from the pattern. Fig. 9 depicts the front and side views of the final rubber-made mould product.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Examples of the present invention will be described with reference to the drawings.

An elastic mould manufactured according to the present invention is used for obtaining a moulding product. First, raw materials are poured into the inside of the elastic mould and allowed to solidify. Secondly, the materials thus formed are taken out as the product.

The raw materials include refrigeration-solidifying ones such as ice, and heat-solidifying ones such as fish paste. There are also some types of fat-containing materials as exemplified by chocolate. Several uses of the elastic mould of this invention will be presented in the following examples.

Example 1

Example 1 relates to the method for the manufacture of rubber-made moulds for refrigeration-solidifying materials such as ice.

Figs. 2 and 3 are the front and side views of the pattern unit to be dipped (A) wherein two patterns (2) extend from both surfaces (1a) of the plate (1). The plate (1) in the pattern unit (A) is likely to be subjected to heat-treatment and should be made of heat-resistant synthetic resin such as polypropylene (PP) and ABS resin, and heat-resistant synthetic rubber such as neoprene and butadiene acrylonitrile rubber (NBR). The pattern (2) can be made of appropriate materials including glass, porcelain, heat-resistant synthetic resins such as polypropylene (PP) and acrylonitrile-butadiene-styrene (ABS) resin, and corrosion-resistant metals.

The pattern (2) can be shaped as required for the product to be formed in the rubber-made mould of the present invention. In order to meet user's demands, fancy patterns such as figures of small animals, for example, can be used in the mould for producing ice cream and chocolate.

The spacing of the pattern (2) on the plate (1) should be so determined that the width of the fixing

sheet (3) is enough to secure the mould unit to the moulding machine.

Although details of the drawing are not shown, the joint between the pattern (2) and the plate (1) should be a rounded corner. This is helpful to make a thickness of rubber film uniform, and also makes it difficult to have cracked rubber surface when the vulcanized rubber film is peeled off from the pattern unit (A). An arc-like plate is more effective for these purposes than a flat plate.

A method for the production of rubber-made moulds according to the present invention will be described in the order of production sequence. First, the forementioned pattern unit (A) is washed to remove any dirt and then dried at about 60 to 80°C for 10 to 20 min. Secondly, the pattern unit (A) is pretreated to facilitate rubber adhesion by means of ion effects. A coagulation liquor containing 40 parts by weight of calcium nitrate, 0.5 parts by weight of glycerine, and 59.5 parts by weight of methanol is used, into which the pattern unit (A) is dipped. Reference should be made to Fig. 4.

In order to avoid air-bubble entrainment and to provide uniformity of film thickness, it is preferable that the pattern unit (A) is dipped at a right angle

to the surface of the liquor. Then, the pattern is pulled out from the coagulation liquor (a) and dried at about 70 to 80°C for about 10 min. to evaporate the methanol. A film of calcium nitrate (m) is thus formed around the surface (1a) of the pattern unit (A). Reference should be made to Fig. 5.

The thickness of the calcium nitrate film (m) associated with dipping into and pulling out the coagulation liquor is generally determined by the rate of pulling out. A pulling-out rate of 100 mm/min was employed in this example.

Since this pretreatment is intended to provide a uniform film thickness as well as to avoid air-bubble entrainment, this step may be omitted when a certain degree of non-uniformity of the rubber film (c) is tolerated. A pretreatment by means of the heat-sensitive method can also be applied wherein a pattern unit (A) is preheated at about 60°C.

Then, the pattern unit (A) pretreated in this way was wholly dipped into the rubber latex solution (b) for about 10 to 15 minutes as shown in Fig. 6. The surface of the pattern unit (A) was wholly covered with a rubber film (c) having a thickness of 0.8 to 1.0 mm as shown in Fig. 7.

The rubber latex (b) had the following solid

contents based on the weight of each component.

60% natural rubber latex	100.0
Non-ionic stabilizer (KAOH CORPORATION: EMALGEN 810)	0.1
Potassium hydroxide	0.3
Sulfur	1.0
Zinc oxide	0.6
Mercaptobenzothiazole zincate	0.7
Diethyldithiocarbamic acid zincate	0.2

The rubber film (c) was developed not only on the pattern member (2) but also on the whole surface (1a) of the plate (1), and the latter part served as the fixing sheet (3). Then, the pattern unit (A) on which the rubber film (c) had been developed was dried and vulcanized at 80 to 90°C for about 60 to 90 minutes. Afterwards, the rubber film was peeled off from the pattern unit (A). (Fig. 8)

Then, the rubber film (c) which had been peeled off from the pattern unit (A) was immersed in a circulating water stream maintained at 60 to 65°C for a period of approximately five hours to remove calcium nitrate and aqueous non-rubber components excluding natural rubber latex. And then, the rubber film thus obtained was allowed to stand in a dehumidifier at 70 to 80°C for about 15 hours to produce a rubber-made

mould.

The rubber-made mould thus manufactured was composed of a bag-like section corresponding to the pattern member (2) and a fixing sheet (3) connecting to the open end of the pattern member (2). Therefore, a rubber-made mould applicable for a practical use can be obtained by cutting the fixing sheet (3) so as to leave the required width of the plate.

Properties of the rubber-made mould thus produced are given as follows:

Low-temperature tensile test

	Ambient	Low temp.
Tensile strength (Kgf/cm^2)	361	529
Elongation (%)	900	790
500% tensile stress	36	88
Permanent elongation (%)	3	-

* Test method

JIS K 6301 (Physical test method for vulcanized rubber)

Test temperature: -25±1°C

Low temp. time: 60 minutes

Low-temperature repeated elongation test

Elongation cycle	State
3000	normal
5000	normal
10000	tore-off

* Test method

de Mattia flexing tester

Test temperature: -25°C

Elongation cycle: 300 cycles/min

Standard distance: 20 mm

Example 2

Example 2 relates to the method for the manufacture of rubber-made moulds for heat-solidifying materials such as fish paste.

Except for the formulation of the rubber latex solution (b), Example 2 is almost the same as Example 1. Description, therefore, will be given only to the formulation of the latex solution (b) and the characteristics of the product or the rubber-made mould. The description of other manufacturing steps will be omitted.

The rubber latex (b) had the following solid contents based on the weight of each component.

60% natural rubber latex	100.0
Non-ionic surfactant (KAOH CORPORATION: EMALGEN 911)	0.2
Potassium hydroxide	0.5
Zinc oxide	3.0
Promoter, tetramethylthiuram disulfide (TT) (KAWAGUCHI KAGAKU CO.: ACCEL TMT)	3.0
Promoter, zinc ethylphenyl dithiocarbamate(PX) (KAWAGUCHI KAGAKU CO.: ACCEL PX)	1.0
Thiourea	1.0
Anti-aging agent (Phenolic)	2.0

The rubber-made mould manufactured by the use of the above rubber latex solution (b) had the following characteristics.

Physical properties

300% modulus (Kgf/cm^2)	13.0
Tensile strength (Kgf/cm^2)	321.0
Elongation (%)	900.0

Heat-resistance test

300% modulus (Retention)	
100°C x 24 H	101.5 %
100°C x 48 H	107.5 %
100°C x 96 H	103.0 %
100°C x 168 H	100.0 %

Tensile strength (Retention)	
100°C x 24 H	95.8 %
100°C x 48 H	92.2 %
100°C x 96 H	88.8 %
100°C x 168 H	78.2 %
Elongation (Retention)	
100°C x 24 H	98.5 %
100°C x 48 H	97.5 %
100°C x 96 H	97.8 %
100°C x 168 H	95.3 %

Example 3

Example 3 relates to the method for the construction of rubber-made moulds for casting fat-containing materials such as chocolate.

Except for the formulation of the rubber latex solution (b), Example 3 is almost the same as Example 1. Description, therefore, will be given only to the formulation of the latex solution (b) and to the characteristics of the product rubber-made mould. The description of other construction steps will be omitted.

The rubber latex solution (b) had the following solid contents based on the weight of each component.

Carboxylated NBR latex	100.0
Non-ionic surfactant	0.5
Potassium hydroxide	0.75
Accelerator, zinc dibutyl dithiocarbamate (BZ) (KAWAGUCHI KAGAKU CO.: ACCEL BZ)	0.25
Zinc oxide	5.0
Sulfur	0.5

The rubber-made mould constructed by the use of the above rubber-made solution (b) had the following characteristics.

Physical properties

300% modulus (Kgf/cm^2)	60.0
500% modulus (Kgf/cm^2)	175.0
Tensile strength (Kgf/cm^2)	316.0
Elongation (%)	580.0

Oil/solvent resistance of vulcanized rubber film

	A	B
Carboxylated NBR latex	1.0	0.8
Natural rubber	164	112
Chloroprene	20	4

* The above numerals indicate the degree of area expansion (%).

A: 25°C Hexane

B: 25°C ASTM #2 Oil

Immersion time: 24 hours

The method of casting by the use of the rubber-made mould thus constructed will be briefly described based on Fig. 1. The method comprises a pouring step X where material is poured into a rubber-made mould, a hardening step Y where the poured material is hardened, and a withdrawal step Z where the hardened object is withdrawn from the inside of the rubber-made mould.

In the pouring step X, low-viscosity material can be easily poured from the top of the mould (2) while high-viscosity material are injected through a pouring nozzle which is inserted in the mould (2). To avoid entrapped air bubbles, the nozzle is gradually lifted as the level of the material being poured increases.

In the hardening step Y, treatments such as cooling, heating, and humidification are carried out, depending upon the nature of the material.

In the withdrawal step Z, the mould (2) is first loosened by pulling the flexible fixing member (3) of the rubber-made mould, and then the object thus hardened is pushed from the opposite side of the fixing member (3) attached to the mould (2). Hence, the fixing member functions as a pulling member, too.

Alternatively, a vacuum can be utilized for removing the hardened product. The fixing member (3)

supports a vacuum chamber which is tightly connected with the mould (2). The object is then withdrawn by applying a vacuum. Hence, in this case the fixing member functions as a supporting member, too.

In the abovementioned Examples, a natural rubber latex as an elastic body-producing solution has been described. However, in addition to the natural rubber latex, a silicone rubber, an urethane rubber and a butadiene rubber of a synthetic rubber can be used.

Any materials as an elastic body-producing solution can be used if they have a flexibility (elongation) to be suitable for use and a restoration.

Further, in case that the finally moulded product is a food, safe and no dangerous materials should be selected.

According to the present invention as described above, a whole of the pattern unit (A) is dipped into an elastic body-producing solution, for example, a rubber latex solution, to form a fixing member (3) as an integral part of the mould (2). The mould provides necessary patterns for castings such as jelly and chocolate while the fixing member provides necessary functions for the withdrawal step.

CLAIMS

1. An elastic mould (M) comprising a pattern and a fixing sheet (3) which is integrally mounted at open edge of said pattern.

2. A method of manufacturing an elastic mould (M) which method comprises dipping a pattern unit (A) comprising a pattern (2) mounted on a plate (1) into an elastic body-producing solution (b) to form a gel-like elastic film (c) thereon, withdrawing the film-coated pattern unit (A) from the solution (b), drying and vulcanizing the film (c), and peeling the vulcanized elastic film off the pattern unit (A) to obtain a mould (M) having a fixing member (3) as an integral part thereof.

3. A method according to claim 2, wherein the elastic body-producing solution (b) is a natural rubber latex.

4. A method according to claim 2 or 3, wherein the pattern unit (A), before it is dipped into the elastic body-producing solution (b), is pretreated with a coagulating liquor (a) containing 40 parts by weight of calcium nitrate, 0.5 parts by weight of glycerine and 59.5 parts by weight of methanol.

5. A method according to claim 2 or 3, wherein the pattern unit (A) is preheated before it is dipped into the elastic body-producing solution (b).

6. A method according to claim 2, wherein the elastic body-producing solution (b) is a solution of one of a silicone rubber, an urethane rubber and a butadiene rubber.

FIG. 1

FIG. 2

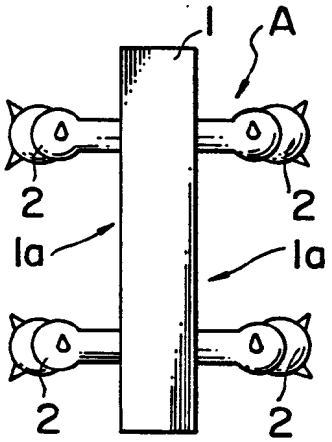

FIG. 3

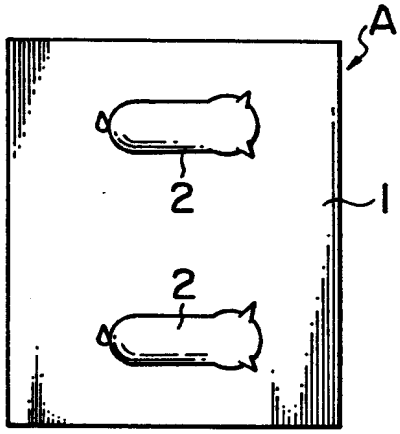

FIG. 4

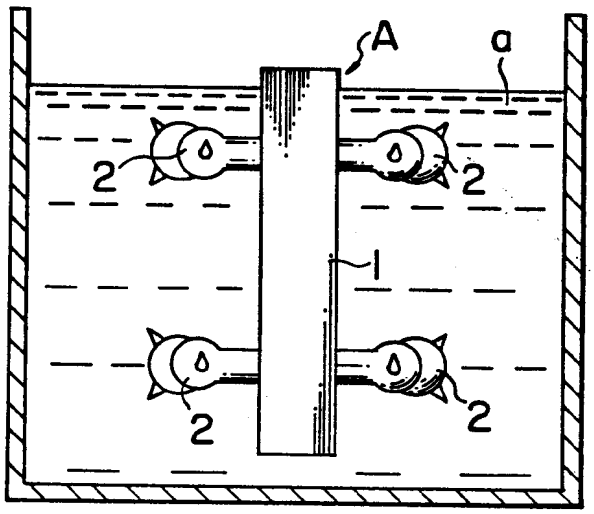

FIG. 5

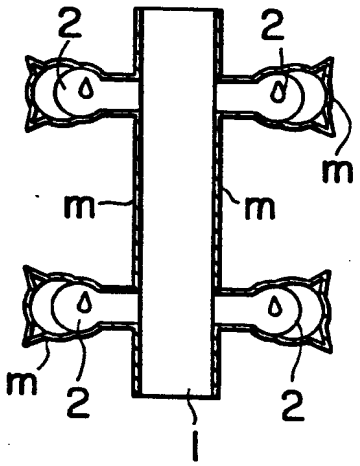

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FIG. 6

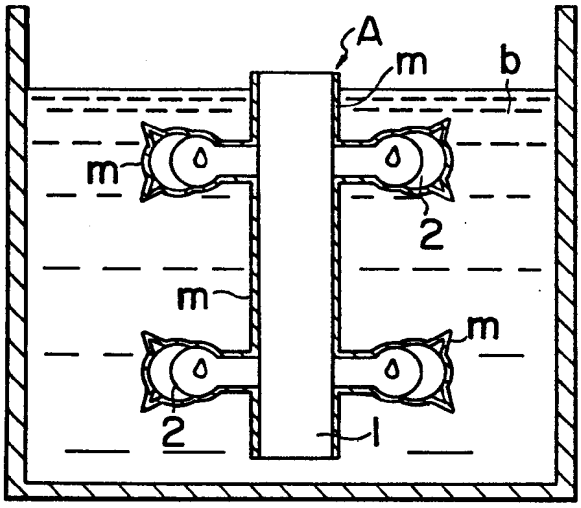

FIG. 7

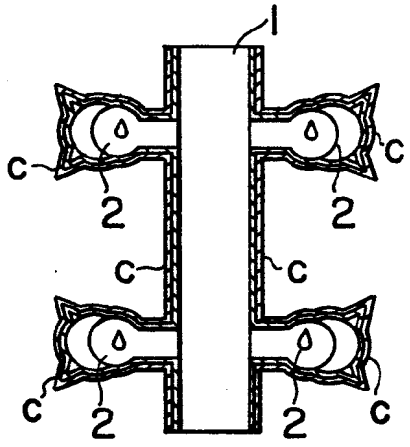

FIG. 8

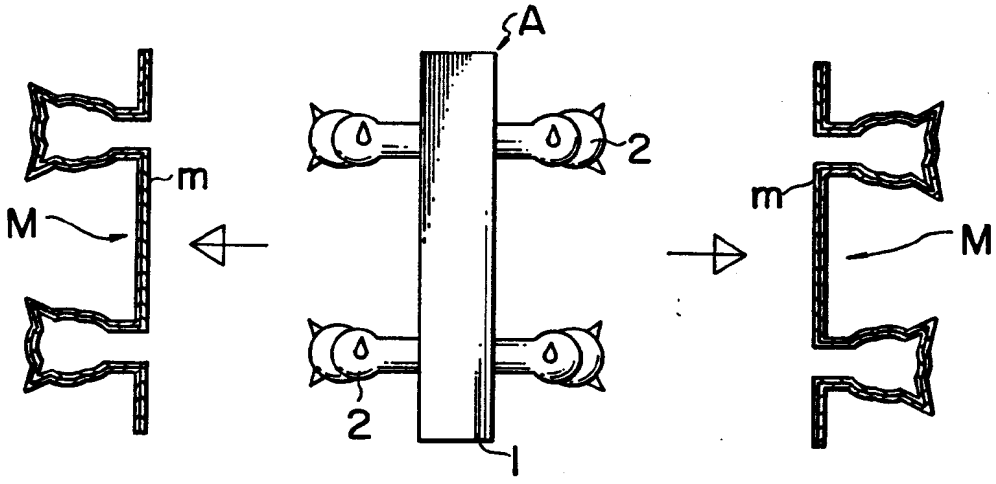

FIG. 9